



Ministerie van Infrastructuur  
en Waterstaat

# The Dutch Delta Approach; if you fail to prepare, prepare for failure

Adapting to climate change.

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## The Dutch Delta in NW Europe

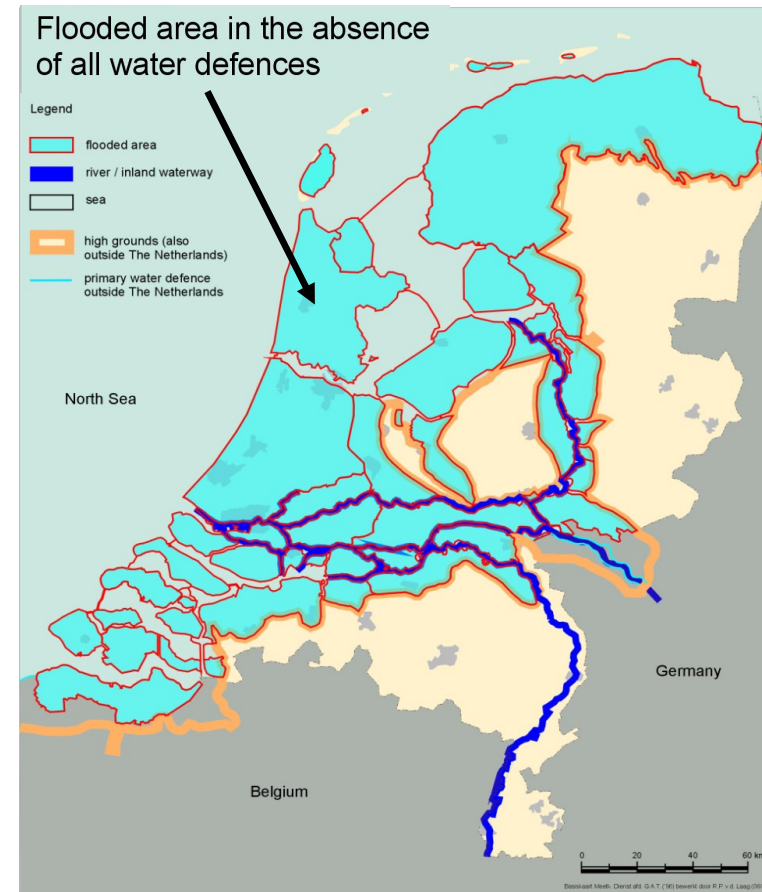
The Netherlands is  
the delta of Rhine,  
Meuse, Scheldt  
and Eems





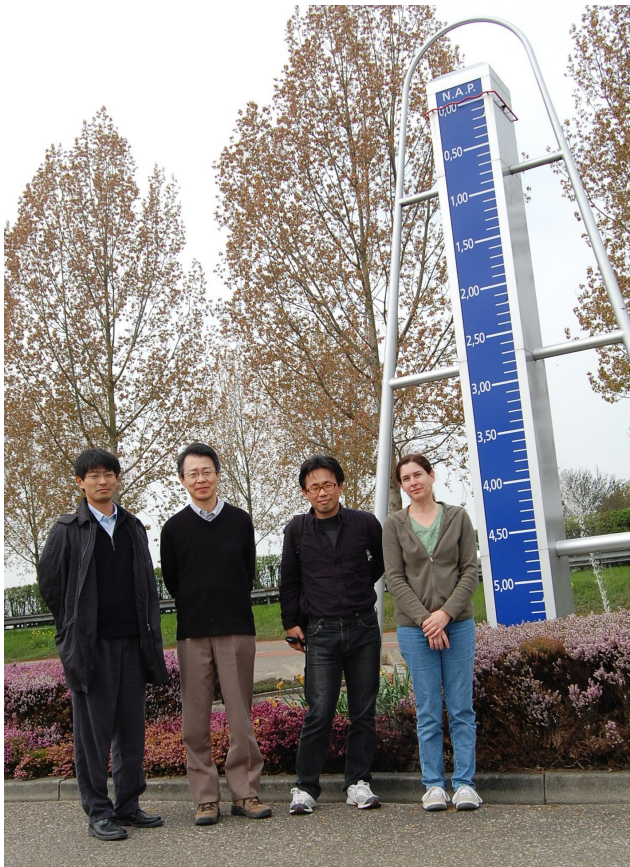


## The Netherlands, 60% flood prone





## Up to 6.70 m. below sea level



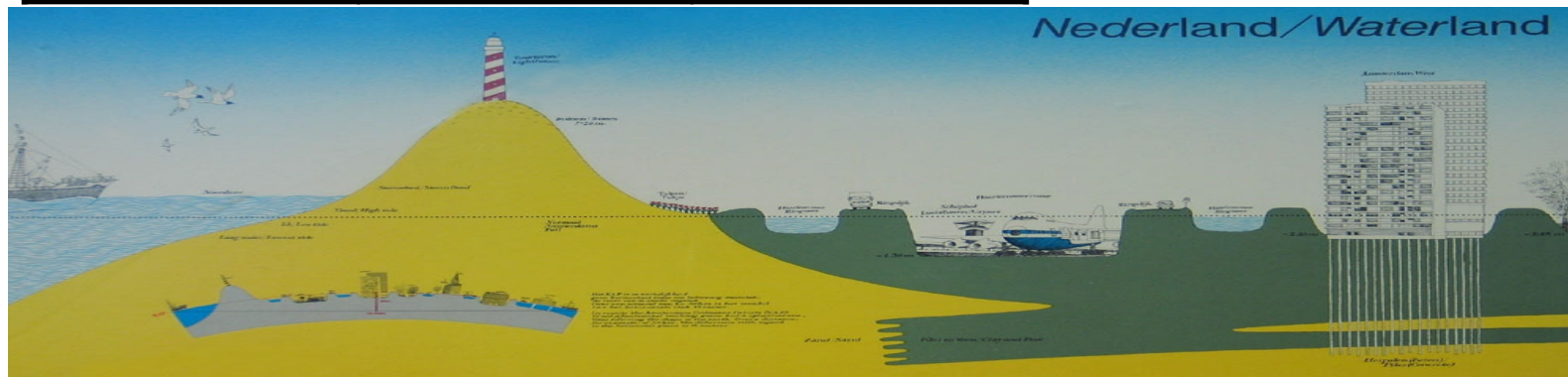
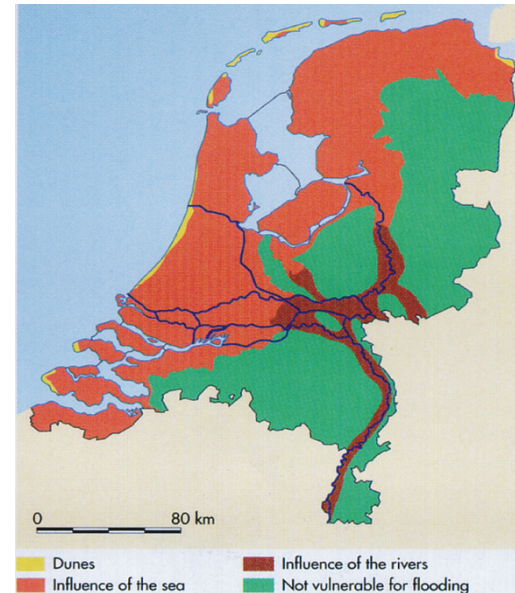
- About 9 million inhabitants below flood level
- Invested value 1800  $10^9$  euro
- Safety level: 1:10.000 – 1:1250
- 3500 km of flood defences, hundreds of locks, sluices, pumping stations





# The Netherlands – protected by levees

	<b>Total</b>	<b>Vulnerable to flooding</b>
<b>Surface Area</b>	41.528 km <sup>2</sup>	55%
<b>Inhabitants</b>	16,8 million	60%
<b>GNP</b>	700 billion US\$	65%





## Major floods 1200 - 1500

Land level sinking below sea level  
Dikes and organization not yet ready:  
fail to prepare

**1212** Noord-Holland **60,000** casualties.

**1219** St. Marcellus' Flood, **killing 36,000** people.

**1287** St. Lucia's flood: **50,000-80,000** people casualties

**1362** Grote Mandrenke killing at **least 25,000** inhabitants.

**1421** 2nd St. Elisabeth's Flood between **2,000** and **10,000** casualties

**1570** All Saints' flood **above 20,000** casualties







# Improving flood protection and making polders



circa 1580



circa 1700

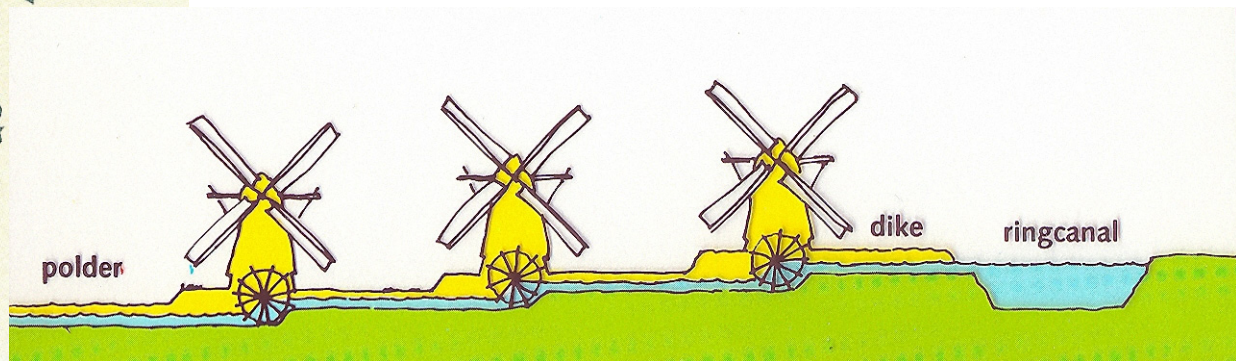
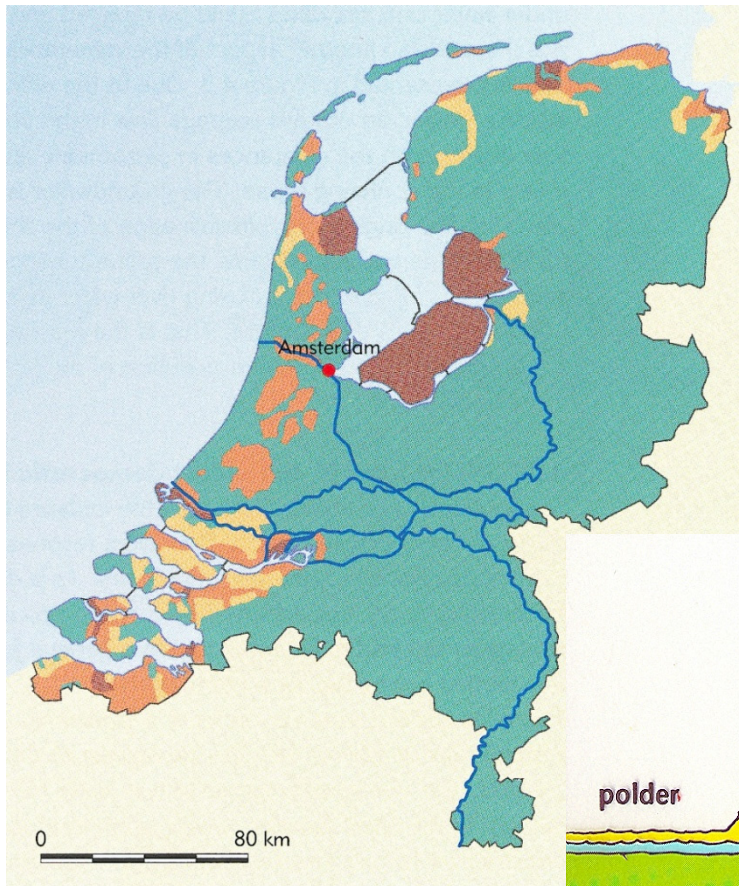


2000





## Centuries of land reclamations works (polders)



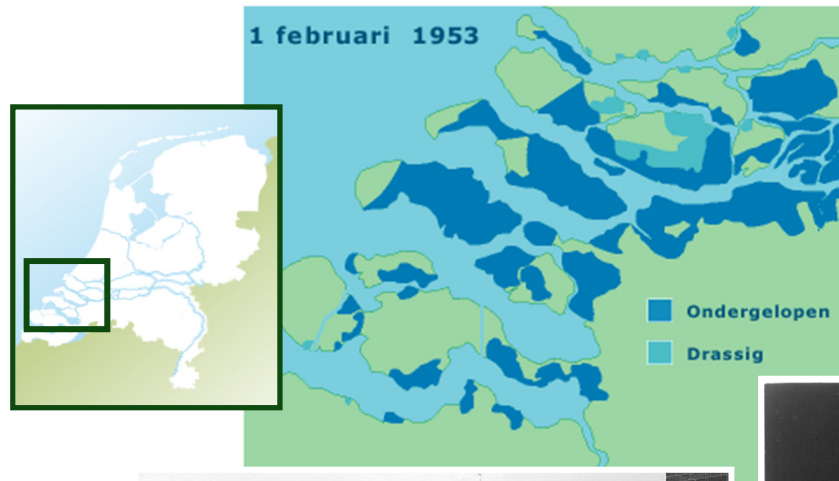
Land reclamation  
1200 - 1600 AD    1600 - 1900 AD    1900 - 1970 AD





# Storm surge 1953, fail to prepare

175.000 ha's land flooded  
1.835 deaths





# The Delta project: prepare

Haringvlietdam

Maeslantbarrier

Brouwersdam

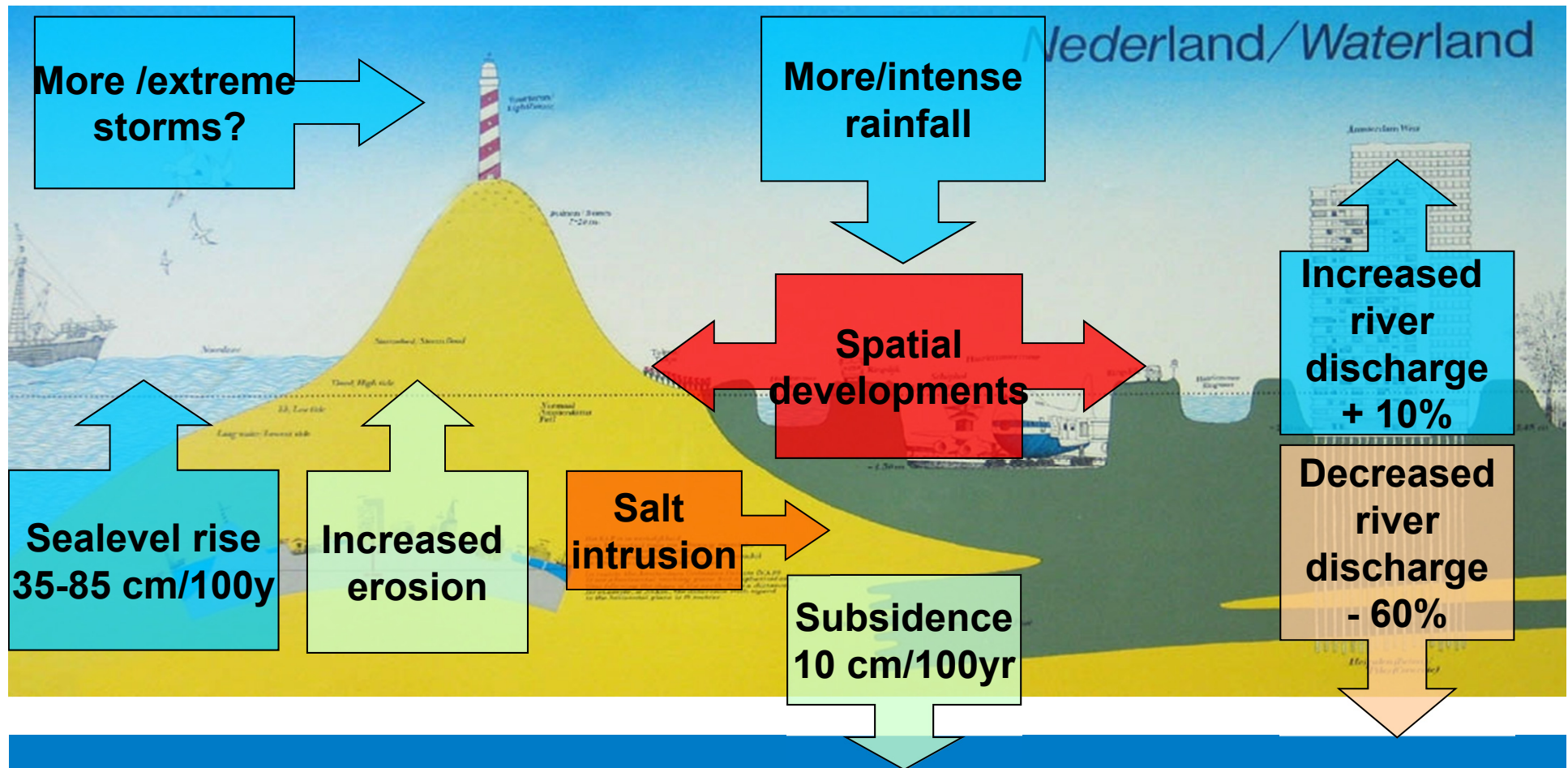


Storm surge barrier in the Eastern Scheldt





# The delta under pressure: future challenges; prepare





# Can we keep it a safe delta with a changing climate?







# An innovative approach: Delta Program

- Not in answer to a disaster, but in advance, to be prepared and avoid it
- Two goals, three values
  - Safe now and in the future [2050-2100]
  - Fresh water supply guaranteed also in dry periods
    - Solidarity, flexibility, sustainability
- Taking into account, spatial planning, water quality, environmental aspects.

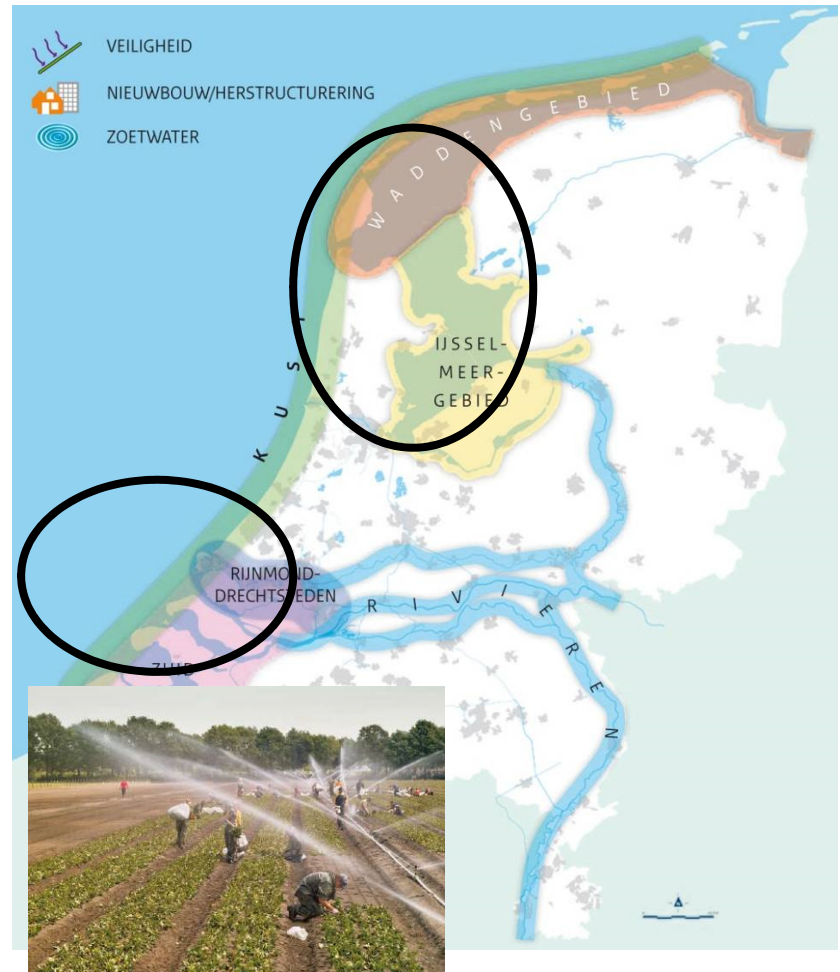
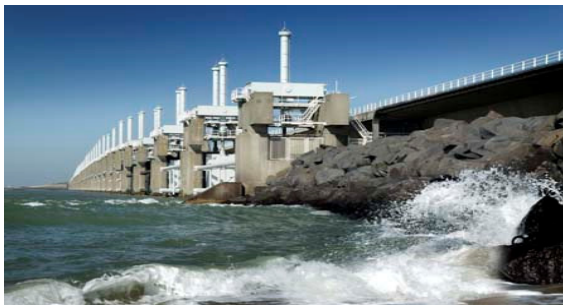




# Delta program

For the Delta program in NL:

- Delta program
- Delta Law
- Delta Fund
- Delta Commissioner
- Delta Decisions (2014)







# The Delta Programme: 2010

## One Aim:

- keeping NL a good, safe and attractive place to live and work for present and future generations (→ 2100, long term perspective)
- Not in answer to a disaster, but in advance, to be prepared or avoid it

## Two Goals

- Safe, now and in the future (2050-2100)
- Fresh water supply guaranteed, also in dry periods



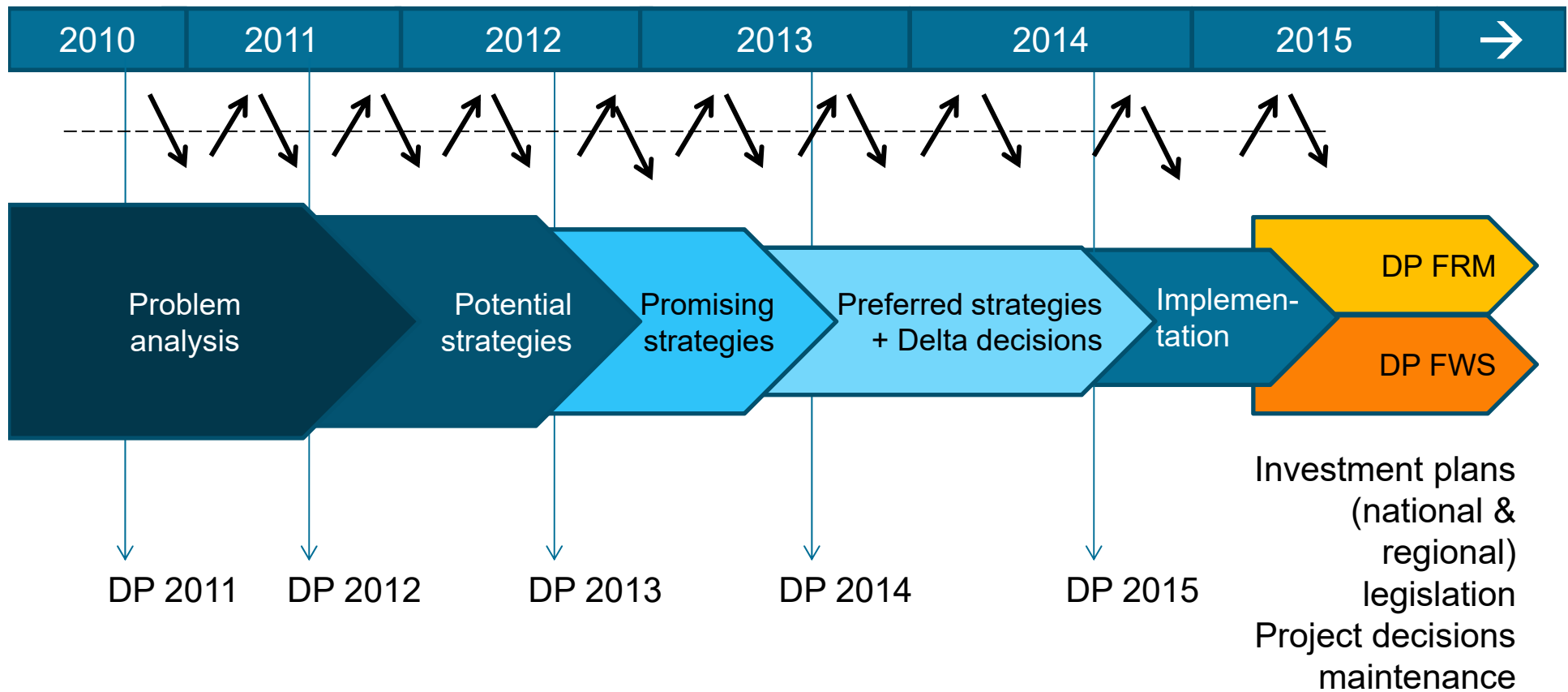
## Delta Programme – not easy

- Uncertainties on timing and impact of change
- Opinions on solutions differ and sometimes contradict
- Many stakeholders in water management
- First agree on scope and timing of the problems, as a basis for debate on solutions
- We call this joint fact-finding





# Towards Delta Decisions and Preferred Strategies





## Delta Programme – Delta Decisions

- Some of our current solutions and strategies will fail in the future
- This can be disastrous. We call this tipping points.
- Avoiding catastrophic events requires some crucial decisions now.
- Such decisions structure all other investments and strategies
- We call them **Delta Decisions**





## Examples of Tipping Points

- Afsluitdijk and sea-level rise
- Salinization of water supply
- Collapse of freshwater economy with increasing salinity levels





# How did we organise the Delta Programme?

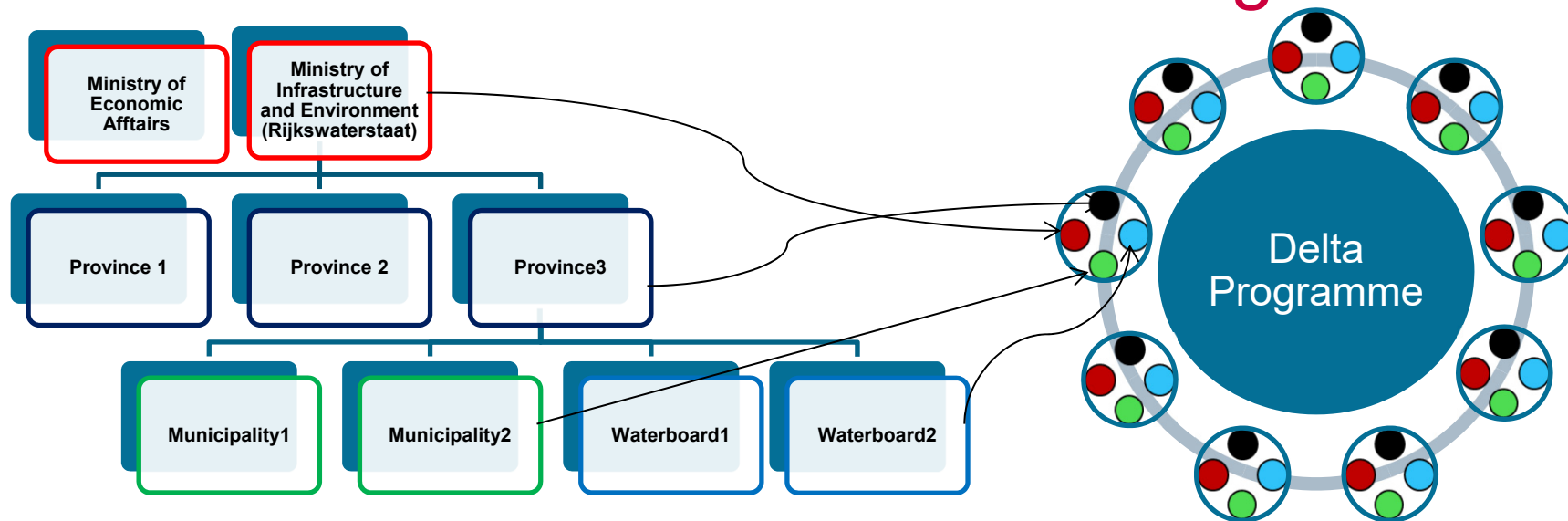


- Delta Act legal basis for:
- Delta Commissioner:
  - progress, uniformity, consistency
  - Prepares yearly proposal for parliament
  - Very efficient
- Delta Fund (1 bln euro/yr)
  - Dedicate financing for continuity!





# Governmental institutions and DP governance



- **Ministries** – Policy guidelines, Rijkswaterstaat - national watersystem
- **Provinces** – spatial planning, supervise municipalities and waterboards
- **Municipalities** – spatial planning, sewage&drainage system
- **Waterboards** – regional watersystem, water quality, water quantity



## Summary

- Provide legal basis for long-term program
- Appointment of special functionary or entity for progress and coherence
- Dedicated financing for continuity (or pipeline of investments?)
- Joint fact-finding and joint decision-making
- Division into logical subprograms
- Development of delta decisions for strategic direction
- Lastly: taking future water availability into account with current investment decisions is **key!**





## Water management – national level

Ministry of Infrastructure and the Environment:

- Management national waterways
- Policy development
- Large flood protection structures
- Early warning
- Maintenance coastline
- International cooperation





## Multi government organization and cooperation

1. Water act: defining responsibilities of all government
2. Agreements within river basin (between national level - waterboards)
  - Discharge of water during high discharges
  - Water quality
  - Distribution of water in dry periods
3. National agreement between government "levels"
  - Flood protection
  - Water treatment
  - Reduction of pollution
4. Direct cooperation in national projects (Room for the River, Delta programme)



## National Floodpolicy

- Dedicated governance structure
  - Strong administrative bodies
    - Central: ministries/  
Rijkswaterstaat
    - Regional: water boards,  
municipalities, provinces
  - Legal obligation to protect against  
floods (Water Act)
- Safety level: 1/10.000 – 1/1.250
- Level safety review: every 6 yrs
- International cooperation

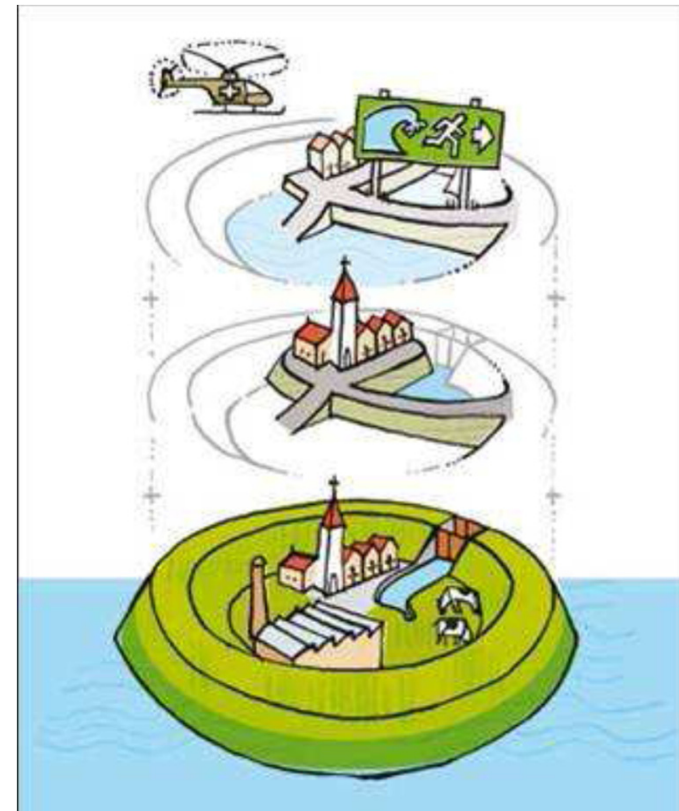






## Multi layer safety approach in the Netherlands

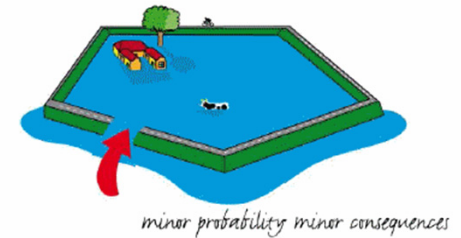
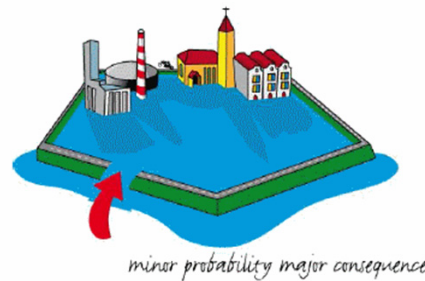
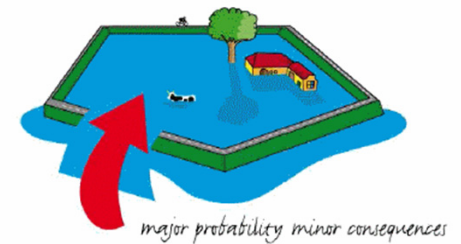
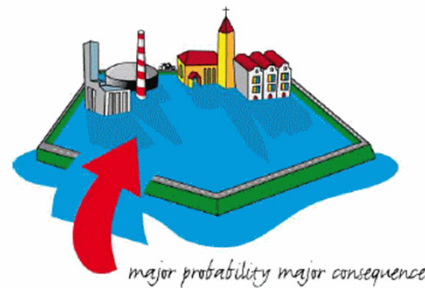
- Prevention  
*Limit the risk of a flood disaster  
(dikes, dunes and barriers)*
- Sustainable spatial planning  
*Limiting the effects of  
flooding*
- Crisis management  
*Reducing the consequences  
of a flood*





## Multi layer approach - Prevention

- Adequate monitoring and assessment of primary flood defenses
- Adopting risk approach for dike rings replacing the overload approach for dike sections
- Reinforcement programs using a risk based approach





## Multi layer approach - Spatial planning

- Combining water management and spatial planning at every administrative level
- Infrastructure concepts
  - Room for rivers
  - 'Unbreachable' Delta dykes



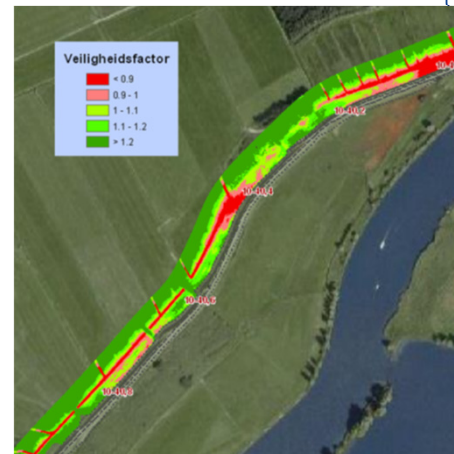
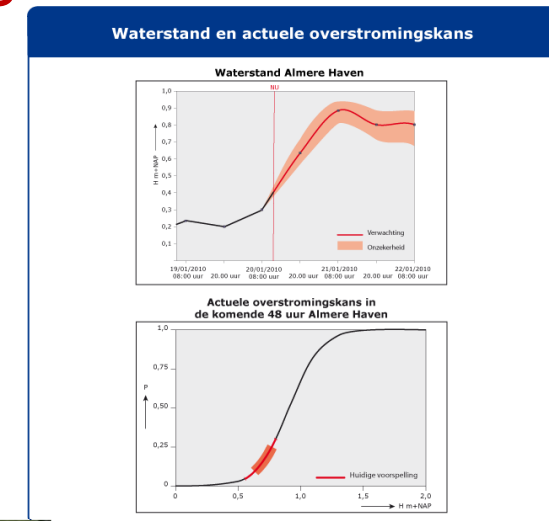
*The 'blue connection' is a passageway between the area of Jsselmonde and the Zuiderpark that enables a connection over water as well as new ecological and economic opportunities.  
Green - Water and greenery blue - Living near water*





## Multi layer approach - Crisis management

- Adequate monitoring and data collection to enable early warning
- Long term reliable predictions
- Decisive crisis management
- Tailor made information for authorities and public





# Improving flood protection along the rivers; prepare



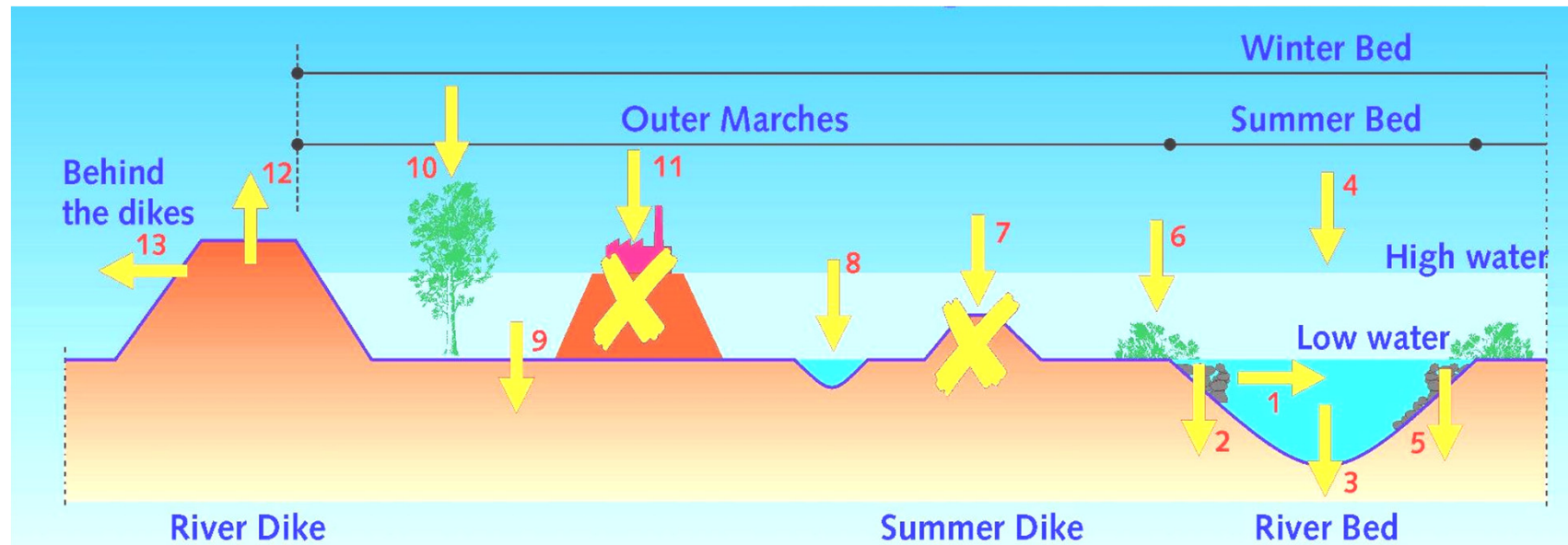
- > 800 km dike improvement 400 M€

- 'Room for the river' 2200 M€





## Innovation: Room for the River



1. Narrowing
2. Lowering spur dikes
3. Dredging
4. Sediment dumping
5. River bed protection
6. Ecologically sound banks
7. Summer dike removal

8. Secondary bed
9. Lowering outer marches
10. Nature development
11. Removal of high grounds
12. Dike raising
13. Dike shifting





# Prepare: secondary river channel at Nijmegen/Lent: room for the river







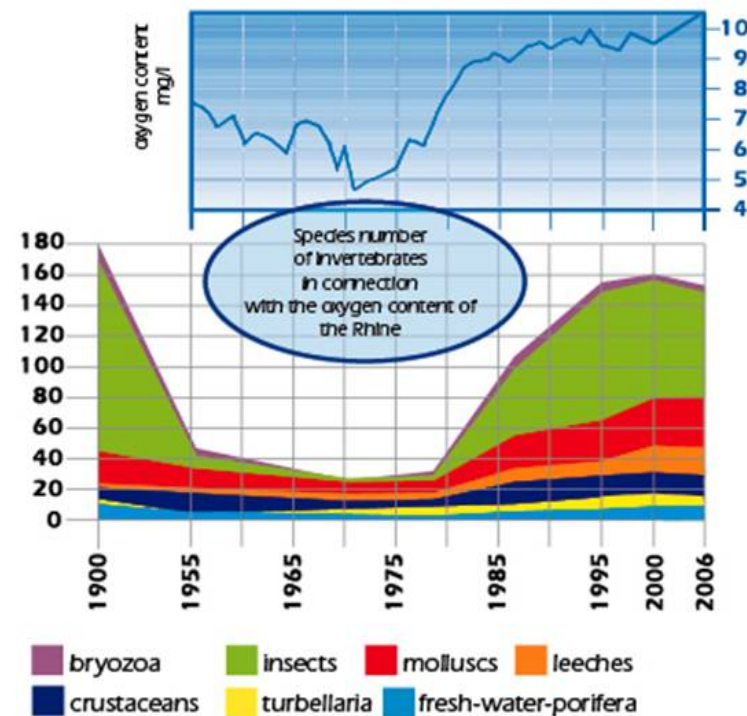




# Water quality

- Law to reduce pollution surface water (1970)
- Construction of sewerage system by municipalities
- Construction of waste water treatment plants (industries and water boards)

Development of the communities of the Rhine and average oxygen content of the Rhine at Emmerich





# Waste water treatment plants

(97% of all households in the NL are connected to the sewerage network)





Thank you for your attention

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